7. Economic and social relations of the project

One of the objectives of the research investigating the regional effects of water shortage is to get to know the inhabitants', the farmers', and the decision-makers' opinions and experiences, since the cooperation and collaboration of the people living in the area is inevitable in the future planning of sustainable water management and liveable environment. Their opinions were explored with the help of questionnaires, and in-depth interviews (Fig. 7.1 on page 331) with decision-makers in the following topics: (1) Which effects of climate change are perceived in the Hungarian and Serbian territories of the Great Plain? (2) How significant is the problem of drought in the inhabitants' life? What effects does the drought have on agriculture? (3) What are the causes they explain the drought with? (4) What kinds of solution can they see to deal with the problem of drought? (5) To what extent do they consider the present farming structure sustainable?

7.1. Questionnaire survey of public opinion on the problem of drought

Péter Szilassi, György Sipos, Mesaroš Minučer

Introduction and methodological overview

Primary social science research uses qualitative and quantitative approaches. Questionnaire is a qualitative method, known in many forms, and its scope depends on what kind of information is needed. In quantitative research, standardized questionnaires are used that are capable of eliciting numerical data from the information collected, provided that the right number of samples are taken. The data obtained can be analyzed by statistical methods, and thus, the answers of a wide variety of respondents of different kinds of educational background become comparable. The questionnaire includes several topics, and the topics related to each other are based on a logical sequence, and transition questions help the development of a logical order. It is important at the survey questions to communicate a uniformly understood content to a heterogeneous multitude, to be brief, simply formulated, and that neither the interviewer, nor the issue should affect the respondent's reply. When constructing a questionnaire, a significant point is that it should not be too long, as disinterest can lead to inaccurate responses (Babbie 2010).

The questionnaire used in the research includes open and closed questions. The respondents are free to formulate a reply to an open question, while at closed questions you must choose the appropriate one of the predefined questionnaire response options. The advantages of closed questions are that the answers to them can be quickly and easily processed, and because of the uniform nature of questionnaires, generalizations are easier to be formulated. We have also used alternative and multiple-choice questions among the closed questions. In the case of an alternative question, decision has to be made between two response variations, in the case of a multiple-choice question, one must choose from the categories specified (a variant of it is the so-called combinative question, which includes an open question in addition

to response variations). The questions include some ranking, where the options have to be distinguished on the basis of the order of intensity.

Identification of stakeholders and characterization of the interviewed people

481 Hungarian and 486 Serbian residents completed the questionnaires in 13 Hungarian, and 11 Serbian border settlements (Fig. 7.1 on page 331). The questionnaire surveys were carried out in settlements where the vast majority of residents live from agriculture, so the environmental impacts associated with climate change are likely to pose a serious problem for them. The questionnaire survey was conducted by using uniformly distributed random sampling throughout the villages with the help of geography and sociology students at the University of Novi Sad and the University of Szeged.

Assessment of results

The significance of agriculture in the economy of the surveyed settlements

Agriculture is of paramount importance in the economy of the settlements. It is supported by the fact that 73% of all the respondents said that themselves or a person of their household conducts agricultural activities on the outskirts of the settlements, or in the area. We also measured the significance of agriculture as a source of income in the survey. Agriculture is of paramount importance in the economic life of communities, as well as in residents' income, since more than 50% of the income of 27% of people conducting agricultural activities comes from agriculture, thus, drought could cause them serious damage. The survey also asked respondents to pick the biggest problems from the specified options (Fig. 7.2 on page 334). Considering the gravity of the problems, unemployment had a strikingly high value in the first place, 80% of respondents mentioned it. The second most important problem is drought, 44% of respondents mentioned it. Based on this, drought is the most significant environmental problem in the region in the opinion of the population, being higher on the list than economic problems such as the lack of investment (31%), or bad government policy (28%).

Climate change and drought

The respondents were asked about the most significant problems faced by agriculture, too (Fig. 7.3 on page 335). The three biggest problems mentioned are drought, permanently low market prices, and high production costs, both in Serbia and Hungary. Drought was highlighted as a problem by the people of the Hungarian and the Serbian settlements, as well. The low level of state aid in Serbian settlements is a bigger problem, while inland water, pests and low soil fertility are perceived as more severe problems in the Hungarian settlements than in Serbia, because of the difference in the proportion of farmers on sand areas.

According to respondents, drought, the decrease of summer precipitation, as well as the temperature increase are the effects of climate change felt most in both the Hungarian and Serbian settlements. All three factors indicate the climate becoming more and more arid. There is a minor difference between the two countries in that the strengthening of climate

extremes and the decrease of groundwater levels are thought to be significant by more people in Hungary than in Serbia (Table 7.1 on page 336).

The fact that the survey was carried out in a dry period, may have contributed to that such a high proportion of respondents thought the decrease of summer precipitation was an impact of climate change. The survey also asked if the respondents could remember in which years drought had affected the agricultural areas around the settlements for the past 12 years. There is no significant difference between people of the two countries in that the "collective memory" records only the climates of the previous few years, the inhabitants do not remember the earlier dry years.

We have asked people living in Hungarian and Serbian border settlements if they have noticed any change in the frequency of droughts in recent years. To the question about the frequency of drought, nearly 50 to 60% of respondents answered that there had been a significant increase in the frequency of droughts in recent years, while approx. 30% of them said there had been a slight increase. The option of significant growth was marked by more in the Serbian than in the Hungarian side, while with the option of slight increase, the situation is reversed (Fig. 7.4a on page 337).

When asking about the significance of the problem, the population of both the Hungarian and the Serbian areas responded drought was a major problem, and it seems that in Serbia it is even more present (53% and 64% chose the "rather serious" category). The phenomenon is also a "sufficiently serious" problem in both countries (40%; 33%). The answers "relatively insignificant" or "not a problem" were given by only a very few.

The impact of drought on agricultural production

One of the main tangible signs of agricultural drought is a dramatic decline in crop yields. In our questionnaire survey inhabitants were asked about the average yield loss observed in drought years. The smallest yield loss was observed by respondents in Klárafalva (33 %) and Szőreg (39 %). Medium yield loss was observed by respondents living in Újszentiván (61 %) and Novi Kneževac (65 %). The most significant decrease in the average yield was observed by the residents of Oroslamos (67 %) Male Pijace (70 %), Horgoš (70 %), Srbski Krstur (72%), and Đala (73 %). There is a group in between which includes the villages where the respondents' estimate of drought-induced average yield loss was between 40-60%. However, it is important to note that the level of drought-induced average yield loss is largely determined by the varieties of plants. For example, corn is more sensitive to drought than wheat.

Public opinion on proposals for solutions to prevent drought

In the questionnaires respondents could choose more than one answer to the question of which solutions they considered the most appropriate to mitigate drought. Irrigation and water storage were mentioned by the most people in both countries, the third option most frequently mentioned was the choice of appropriate plant varieties (Fig. 7.4b on page 337). Those who have access to irrigation, irrigate from groundwater wells or irrigation canals. On the basis of results obtained we can conclude that the use of irrigation canals is more common in the Serbian side of the border than in the Hungarian side.

7.2. Interviewing agricultural stakeholders and landowners

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Introduction and methodological overview

The in-depth interview is a qualitative assessment tool of primary social science research, where the nature of the data to be obtained is qualitative, usually a small sample is queried, and problems and motivations can be revealed with the help of it. The in-depth interview also allows for better communication between the groups involved compared to questionnaire studies, and helps to explore such falsehoods and misconceptions which questionnaire surveys do not reveal. Compared to questionnaire (qualitative) research, the in-depth interview requires significantly more consideration from the respondents (Babbie 2010).

The method used in the research is the semi-structured interview, where the interviewer uses a scheme while questioning, but can flexibly differ from that: the interviewee's answers influence the wording and the order of questions. Open questions used in this interview type allow respondents to formulate their thoughts with their own words. The method applied can be considered a thematic interview, because it does not focus on personal topics, but collects data on views and experiences on a subject specified, the water shortage problem in the region in this case. The interviews were conducted by the so-called "field" technique, that is, in the natural environment of the interviewed people. The flexible structure of the interviews requires the researcher to be present on the location, and be involved in the survey. Analyzing the interviews highlights the environmental awareness and willingness for sustainability of the farmers in the region.

The main purpose of the assessment of in-depth interviews is that knowledge, opinions and interests of the farmers' and decision-makers' interviewed come to the surface. The scheme of in-depth interviews focuses on problems of natural sciences, which are significant and important challenges facing the region today, and, expectedly, in the future, too. The preparation for these is essential in the levels of farming and decision-making, as well. Strategies and plans are necessary to achieve proper adaptation, but realistically enforceable strategies can arise only by exploring the stakeholders' opinion.

Identification of stakeholders and characterization of the interviewed

Two target groups were defined during the project: farmers and decision-makers. The farmers directly perceive the significant effects of water scarcity, also resulting in huge economic loss, through its impact on agriculture. Exploring the views of this target group in terms of practical experience is very important. From the decision-making side, the criteria and essentiality of the effort to solve the problem can be explored.

Several groups can be distinguished among the stakeholders on the basis of their involvement and interests. For example, on the basis of farm size and type of farming, the farmers' decision-making capability and dependence on negative environmental effects may be different. All of the settlements in the region may be affected by the problem investigated. The ex-

tent of their involvement is influenced by the geographic location (e.g. in the blown sand area they are more strongly affected than in settlements along the Tisza), whereas their adaptation possibilities can be significantly determined by the size and the economic opportunities of the settlement.

33 settlements and 52 subjects have been interviewed in the Hungarian side. Out of the 52 interviews 30 interviews have been carried out with farmers and 22 with municipal decision-makers. Major farms, which have a significant area and more resources, are represented by some farmers interviewed, as well as smallholdings having less land and fewer resources, thus, having less leeway to adapt; there are part-time or hobby farmers, who also have a different approach again, because their livelihoods do not solely depend on agriculture. At the selection of decision-maker interviewees it was an important point that all the main types of settlements in the region should be represented. Both the village settlement category with small villages with less than 2000 inhabitants, and townships, large villages with more than 2,000 inhabitants have been involved in the research. The smallest settlements involved have a population of only around 5-600. Representing the towns, there are small ones of about 5-10 thousand people, medium-size towns with more than 10 thousand inhabitants, and county rank towns, as well. When selecting the settlements and the interviewees, we tried to ensure that inhabitants and farmers from soil types and topography with different levels of involvement in the risk of drought be represented. There are two main types of soil in the area in terms of drought hazard: the sandy soils with extreme water household, and soils with finer texture (mainly chernozem and meadow soils). 21 settlements are situated predominantly on sandy soils, and 12 settlements on chernozem and meadow soils.

In Serbia the targeted research population includes active farmers and agricultural businesses that are major stakeholders in agriculture in the area of research. Using natural sampling method, a total of 43 farmers and 7 representatives of agricultural businesses operating in the area of research were interviewed. For the purpose of research of attitudes of the agricultural population and the stakeholders in agriculture, a survey questionnaire comprising 53 questions was compiled. For the purpose of clarity and easy processing, all of the questions in the questionnaire were divided into five parts. The first part is related to research of socio-demographic characteristics of the respondents (gender, age, education). The second part contains questions concerning characteristics of farmers and agriculture (experience in agriculture, size of agricultural land used by the farmer, soil fertility category, crops grown). The third part is related to occurrence of drought and consequences of drought periods. The fourth part deals with research of opinions on efficiency in water management in the research area and sustainability of agricultural production through adaptive strategies to climate changes. The fifth part looks into research of possibilities of prediction of occurrence of drought and drought periods, as well as the role of government institutions in providing aid and support to farmers and agricultural development of the region in general. Data collection was carried out by the method of telephone interview. Majority of the respondents own agricultural farms on the territories of Srbobran, Čenej, Kać, Kovilj, Bečej, Begeč, Despotovo and Đurđevo.

Overall, 73 farmers and 29 decision-makers have been interviewed on the two sides of the border.

Assessment of results

South Hungary

In terms of involvement in drought and inland water, farmers and decision-makers have given an account of similar experiences. The majority (16 farmers and 17 decision-makers) said that both the abundance and the shortage of water posed a problem (Fig. 7.5 on page 343). Many people responded (13 farmers and five decision-makers) that water shortage was a more serious problem; they live mainly in higher elevations of the sand blown area, where water quickly seeps in. Only one farmer responded that his land was more strongly affected by the abundance of water / inland water. It emerged as a problem that inland water and drought occurred within a year. There is often plenty of water in spring, but there is often drought in summer. The lack of water in the region is a major problem based on these data, as 51 out of 52 interviewees replied that it caused significant difficulties.

Farmers and decision-makers also think similarly about changes in the frequency of drought years. Nearly all of the farmers and decision-makers interviewed perceive that in recent decades the frequency of drought years has increased (Fig. 7.5b on page 343). Only one farmer and one decision-maker said that the frequency of drought years had not changed, but they also noted that the intensity of droughts had increased and the extremes had become more common. The farmer interviewees also emphasize that not only the frequency of drought has changed, but the appearance of drought in time has also been changing, since nowadays drought occurs earlier in spring, whereas in the past it was more typical of July and August only. There is an increasing number of extremely hot days, high heterogeneity of precipitation, high extremes, in summer there is often no morning dew. The phenomena observed in the settlements are rising average temperatures, hotter summers, more hot days, and the observed physiological effects.

In the point of factors increasing the risk of drought, unfavourable soil properties and decreasing levels of groundwater were considered negative factors in nearly the same proportions (Fig. 7.6a on page 344). Sandy soil has been defined unfavourable. A few farmers and local decision makers do not see any factor increasing drought; they are mostly from areas with more fertile soils, with good water supply. Several people mentioned specific factors increasing the risk of drought, more people among decision-makers than among farmers. Human intervention was mentioned as a drought risk increasing factor, for example, the growing number of drilled wells and increasing forestation, which cause the sinking of groundwater, but a view also appeared to point to a decrease in forest cover as a drought risk increasing factor; or flawed water management interventions (e.g., drainage canals that continuously deliver water away from the area).

Many mentioned the sinking of groundwater levels as an important drought risk increasing factor. We have surveyed the importance of this factor in a separate question to make visible the extent in which the people in the region consider it to be a problem. 25 out of the 30 farmers interviewed notice the sinking of groundwater levels (Fig. 7.6b on page 344). 13 people said that it significantly affected production. They are mainly farmers living in the higher elevated areas of the blown sand area (e.g. Kelebia, Kecel, Jánoshalma, Mélykút,) and in the vicinity of Ásotthalom. Only five respondents replied that groundwater levels were not dropping. They do not live in a specific area separable, but all of them manage lower-lying lands within the region.

Decision-makers in most of the settlements also reported significant extents of groundwater sinking that affects agricultural production, too. The settlements reported varying degrees of sinking, in the lower parts of the blown sand area it is only 1-2 meters, in the higher areas it is 2-3 meters, at the height of Borota-Jánoshalma it can be up to 5-7 m compared to the 1970s. Lower-lying villages around Szeged, nearer to the River Tisza, reported that they had experienced no decrease in groundwater levels.

Effects

Crop yield loss is one of the most important consequences of drought in agriculture. Its extent varies greatly depending on the type of crops grown, on irrigation possibilities, on soil type and on the location of the area. The opinion of the farmers interviewed in non-irrigated farms is that even a 50-100% yield loss can occur, the biggest loss is usually observed in corn. This highly significant yield loss can also be caused by that plants almost burn due to heat, and even if there is sufficient soil moisture, plants cannot take it up (e.g. corn). Summer heat shock, when the plants shed their foliage, is becoming more common in the region. It was said about the relationship between yield loss and soil that harm was greater in sandy areas than in loamy soils. Drought does not only result in quantitative damage, but the nutrient content also deteriorates. The oil content of sunflower and the sugar content of sugar beet decreases. It is not good either if there are no grains in the crop for silage, because the nutrients are in them. Deterioration has also been observed in the case of orchards, e.g., smaller apples have grown. The lifetime of perennial plants can decrease as a result of drought (e.g. asparagus). The interviewees said about the relationship between yield loss and crop varieties that spring crops were generally more damaged. Corn, asparagus, sunflower (summer drought), field forage crops, potatoes (summer drought), apricot and peach, rapeseed (autumn drought) and vegetables (no longer possible to produce without irrigation) are the least resistant to drought in the opinion of farmers. Another problem is that dry periods are very favourable for insects and beetles. Farmers say that, with increased drought, new pests have emerged compared to previous years, for example, whitefly in the field of green peas, the appearance of Mediterranean species: Tiger mosquito, Colorado potato beetle, Tomato leafminer. The intensity of insect damage has also changed, locusts or leaf caterpillars cause increased damage in the years of drought, which gets worse due to the weakened condition of plants. The experience of the farmer engaged in forest management is that the most drought-resistant species are the acacia and the pine, but their wood is not going to be of very good quality, either.

The urban green areas of settlements (playgrounds, sports fields, ornamental gardens, alleys, and green spaces) are significantly affected by drought, as well, according to decision-makers. A significant number of settlements try to prevent degradation by the irrigation of green areas. The public parks in certain places have to be watered from May to September, that is, in the whole vegetation period, which entails significant costs. Those who irrigate report that the more sensitive plants become extinct or have become extinct, and therefore, trees that do not grow very big, are being looked for by them, for example, ash, maple, hawthorn, and other species that have lower water demand. The decision-makers have reported that the Turkish hazelnut has not been able to survive in the past 3 years; hawthorn and birch trees are not present in future plans any more. Today only ash and certain ornamental pear varieties can

survive without irrigation. Where groundwater is not available, they irrigate from subsurface aquifers. Several people reported that public parks should be watered more than earlier, which also shows the growing number of drought periods. Some settlements on the top of the blown sand area, where groundwater is no longer available for trees, do not irrigate, because they could only use potable water, from deep aquifers, and they do not consider it to be sustainable.

On the question of the impact of the previous extreme year on the produce of the given year, the farmers' opinions are not uniform; they could not clearly take sides. They cannot really formulate the correlations, cannot see the coherence of the following years clearly. Several interviewees think there is absolutely no effect of years with different water conditions on each other. The farmers farming on sandy soil think this is because of the low water retention capacity of their lands. Spring inland water has no effect in summer, the water reserves of the soil run out in a few days in periods of drought. In contrast, it was also a view that the previous year's inland water can moderate the effect of drought next year on sand. Better crop yield after a year of inland water has been reported from areas of soils with heavier structure, but it is also possible that the huge amount of precipitation in a humid year with inland water inundations washes away the nutrients from the soil, which will further weaken plants in the next, arid year. Another farmer says inland water does not have an effect on the following year, but the previous year's drought does, on the very next one.

Adaptation

Many farmers interviewed are trying to adapt to increasing droughts by the selection of appropriate species, and by the modification of crop structure. More farmers are experimenting with drought-tolerant / hybrid / resistant species, but opinions on their effectiveness are divided. According to the farmers, there is progress in the selection of species, there are more drought-tolerant varieties, which are generally more expensive (and not necessarily better). There are some farmers who try new plants, but only one out of about 10 experimental varieties endures the circumstances. When choosing species, farmers first consider the growing period. They choose plants of short growing periods, for example, the earliest peas, vegetables, so that their maturation does not last in the very dry period. The cultivation method can also significantly improve production. Several farmers say that they are trying to plan sowing in a way that adapts to the soil types and their fertility. Crops with high water demand are sowed into soil with better water holding capacity, or lying deeper, because it dries out later. Experience is that it is not worth sowing the drought-tolerant variety into good soil, because it generally has lower yields. Another possibility of adaptation is plant culture change, but it is very difficult where the particular culture requires a high-cost, specialized infrastructure (e.g. potatoes). Those who are engaged in animal husbandry, and feed cultivation is attached to it, cannot switch, since corn and grain must be grown to feed animals. It is hard to change a plant culture in the case of orchards and vineyards, as these are long-lived plants, and the possibility of switching is slower, the success or the failure of new breeds can only be discovered several years later. Changing is difficult for smallholders because of economic constraints, today it is not easy to change, since everything has a large supply, and the existing circle of clients should be maintained. Those farmers who are elderly, and where the younger generation does not

want to take over the farm, do not want to get into a more serious plant culture change, because they do not want to learn about new plants, and purchase new equipment.

About two thirds of the farmers interviewed irrigate, and irrigation investment needs are estimated by them at around 30%. They are mostly major farmers who cultivate hundreds of hectares, where the potential loss of money due to drought is high, so they have constructed irrigation systems. The investment of farmers of vegetable gardens or smaller areas is much less than 20%. The majority of farmers irrigates from wells, most with water reels, and micro-sprayers. Only a few of the larger farms have a canal irrigation system. The significance of irrigation has been emphasized by the majority of the interviewees. Experience has shown that irrigation and nutrients can double the yield, and although it has potential, it is also very expensive. The present structure of land ownership is not favourable for irrigation, either, and to make large investments in rented land is uncertain. The lack of financial resources is also a problem of small farms, they cannot develop. Large irrigation schemes are not worth the installation, so farmers should unite. Respondents highlighted the infrastructural and regulatory gaps as a problem of irrigation, as well. They mentioned that a more flexible water abstraction regulation was needed. Environmental problems related to irrigation have also appeared in the answers of some respondents, who highlighted the poor quality of water in the irrigation canals.

Urban drainage in settlements is usually solved; a bigger problem is drainage in outlying areas. Six settlements surveyed said that drainage was well resolved in the settlement, and 12 settlements constantly face challenges. There are settlements where the excess water problem occurring from time to time is thought to be best solved with several smaller channels, which would also be available for water management: they could retain water for drought periods. In some settlements drainage problems are caused by man-made structures, as well (e.g. highway). Settlements on the higher elevated blown sand areas replied that there was no need for drainage, since even after major rainfall events water remains on the surface only in local depressions.

There is no need for drainage from arable lands in the farms located on the higher elevated parts of the blown sand area in 13 settlements surveyed, where farming is done on sandy soil, or groundwater is deep down e.g. Kelebia, Kecel Ásotthalom. In the rest of the settlements excess water causes problems in humid years, but only a few said that drainage was well resolved. The main problems reported are: improper maintenance of the network of inland water drainage, and the poor state of the drainage channel system, the renovation of which would improve the situation.

Farmers in most cases showed strong willingness to take steps for better water management, but currently only five of the 30 farmers interviewed have the opportunity to do so, and mostly for water retention. A significant number of respondents, a total of 14 people, would see the implementation of water management (e.g. water retention, water storage) necessary, however, they even have no water-retention capacity at the moment. The other respondents do not perceive the need for water management, or do not have a choice, because the lack of water in farming is a less important factor, instead, the abundance of water is more common, and constructing drainage channels would be a significant investment.

Improving the region's water supply is considered important by the farmers interviewed. The majority of respondents see the importance of state, or local organizational (e.g. Water

Authority) participation in the realization. In addition, the involvement of community-based management, individuals, and farmers is also considered important by them. The roles of three different action levels have different importance in the interviewees' replies. Some people consider the role of the state to be the most important, where the development of a subsidy system should be initiated from the top levels, which would be an incentive for the farmers to cooperate. For others, the focus is on local governance, and water resources should be managed by local professionals, since they know the region, and can make a decision on the spot. Others mentioned the combination of initiatives starting from higher and lower levels. The government and the water authority would be responsible for water management and supervision in this scenario. Farmers have a great responsibility, but the farmers' intentions and possibilities for cooperation are limited at the moment.

Sustainability

The farmers interviewed are divided on the question of how sustainable the current cultivation is in the region (Fig. 7.7.a on page 352). Only a small part of farmers (four interviewees) believe that the current management is definitely sustainable. Most of the farmers interviewed believe it will be sustainable, but only together with adaptation to changing circumstances. There are two distinct groups among them, the first is fundamentally optimistic, and believes that farming is sustainable with appropriate adaptation. The other group of farmers has confidence in the future, but they have doubts about sustainability (in the higher blown sand areas, traditionally agricultural, many people give up arable cultivation and instead, start forestation). Irrigation is a key element in the sustainability of farming in their opinion. The importance of changing cultivation techniques, plant culture change, optimization of plot structure, and complex technological solutions also appeared in the responses. A farmer points out that agricultural sustainability is not only a problem faced by the farmers, it is a social problem, too.

In most decision-makers' vision of the future, adaptation and sustainability appear as important factors. They see that sustainability can only be achieved by adaptation to changing circumstances (Fig. 7.7b on page 352). One decision-maker is of the opinion that the practical reality of sustainability requires regulation and local markets, especially in this high-yielding region, where agriculture has a huge potential. There are settlements where intensive farming is seen to be the road to the region's sustainability by decision-makers. In many cases the fact that the population is aging is an influencing factor; young people no longer run the farm of their parents, so sustainability is also questionable in this respect in the future.

The need for and potential of forecast have sharply divided the farmers. Approximately one third of the interviewees think that it is not necessary or does not make sense. Mostly because they think that it is not feasible, since the weather forecast is not reliable, either, and to make a long-term forecast of high precision is difficult. Several people consider more important to improve farming conditions in solving the region's water supply, e.g. markets, manufacturing industry.

Farmers and decision-makers see a lot of solutions to the problem, but now they are actually puzzled, and they trust in the expertise of the future hydrological, engineering and research community. Unanimous opinion has been worded in the following proposals: prepared professionals are required; the existing channels should be maintained; irrigation and water storage

should be done efficiently; a well-defined, long-term social goal is needed to formulate a new comprehensive concept and a strategy of water management for rural development, conservation, and agricultural demands; flexible river water abstraction in the settlements lying near the rivers; water management and selection of adaptable species; prevention of natural deterioration; keeping water on site; taking local factors into consideration is necessary.

Vojvodina

An equal number of farmers are also land owners who lease additional agricultural land (20 individuals) or they are owners of an agricultural holding (20 individuals), while a few lease agricultural land (3 respondents). As far as other stakeholders in agriculture are concerned, those are either legal entities or cooperatives. Farmers typically work on smaller agricultural plots of land, with size ranging from 0.25 to 250 ha. Larger agricultural farms are in hands of stakeholders in agriculture whose plots of land range from 300 to 1570 ha. Majority of the respondents own agricultural farms on the territories of Srbobran, Čenej, Kać, Kovilj, Bečej, Begeč, Despotovo and Đurđevo. Local farmers mainly work on land of good (1st and 2nd) soil fertility category. In the research area the following crops are predominantly grown: corn, soy, wheat, sugar beet, and sunflower. On smaller plots vegetables are mainly grown: potato, cabbage, onion, pepper, and carrot. As for work experience in agriculture, almost all farmers have more than 7 years of experience (42 respondents), while the agricultural firms have operated for more than 6 years in 80% of the cases.

As the main problems in agriculture, the local agricultural population lists absence of strategic planning and management of agrarian policy, as well as absence of state support to farmers in agriculture development. The respondents very often mentioned generally inadequate financial policy, primarily concerning high costs of agricultural production, uncertain market placement of agricultural produce, and low prices of purchase. Absence of adequate irrigation systems, as well as the fact that the existing ones are obsolete and not maintained, is stated as a serious agriculture-related problem in the region. A few respondents listed frequent occurrence of natural hazards (drought, frost, hale, strong winds, and incidence of plant diseases), and the fact that individuals in agriculture are insufficiently informed or competent (Fig. 7.8a on page 354).

In the investigated region drought is a very frequent natural hazard, which is in compliance with the obtained findings that almost all of the farmers included in the survey suffered a drought period (42 respondents). The year 2012 was rated as the worst year for agriculture. The respondents state that consequences of drought that occurred in 2012 were felt in 2013 as a lack of funds for investment into agricultural production. According to the respondents, the average length of drought periods was 4 months.

Effects

The gravest consequences of the drought periods were reflected in crop yield. In 2012, according to the replies of the local farmers, the crop yield declined by as much as 53 % (minimum decrease of 10%, and maximum of 80%), while the agricultural firms had a decrease in crop yield of 34% (minimum 20%, and maximum 55%). Apart from the reduced yield, the local agricultural population stated increase in irrigation costs, higher costs of working on dry and

hard soil, and occurrence of plant diseases (fungi on corn that cause incidence of aflatoxine) as consequences of drought periods.

Corn and soy were most severely affected by the occurrence of drought. Taking into consideration the fact that Vojvodina is dominant in production of corn (58%) and soy (94%) in comparison with the whole territory of Serbia (Executive Council of Vojvodina, 2006), the drastic fall in crop yield in the drought period of 2012 had influence on the total national economy, especially on income from export of agricultural products that creates foundation for agricultural growth and development of agriculture in Vojvodina and in Serbia in general.

As for the amount of information the farmers have on occurrences that cause drought and drought periods, majority of them consider that drought is a consequence of climate change, i.e. global warming (25), while 8 of the respondents consider that they are not educated enough to give an answer to that question. In the researched region 26 respondents of the respondents think that drought is caused by heat waves, 6 respondents are of the opinion that drought occurs as a result of water shortage. A total of 11 of the interviewed persons consider that drought is a consequence of shifting influence of both these factors, i.e. that heat waves boost evapotranspiration and then plants structure lose water as a result of evaporation of water from plants' surface, soil, as well as through physiological process of transpiration. In the conditions where both factors are present, the respondents think that intensity and duration of drought periods are extended. Representatives of agricultural firms, majority of the respondents (5 respondents) consider that drought is caused by water shortage (Fig. 7.7b on page 352).

Adaptation

Majority of the respondents do not irrigate their agricultural land (28 respondents). The individuals who do irrigate theirs (14) mainly use water from wells or canals in their surroundings. As many as 16 of the farmers do not have irrigation canals, while 10 of those who do have irrigation canals say that the canals are not functional, and they are outdated and dry in the summer season. It can be concluded that the present situation in irrigation, observed through the total number of irrigation systems, is not on a satisfactory level, neither by its scope, nor by its equipment, the level of use related to water capacity of Vojvodina, or the needs of agriculture. Majority of the respondents do not make any additional financial investment in irrigation, and in their opinion investment from personal income would not be financially viable or feasible. As the answer to the question who should be responsible for improving the irrigation system in the region of research, majority of the farmers consider that it should be responsible institutions and government departments in charge on national level (20 respondents) (Fig. 7.9a on page 357). A total of 10 of the respondents are of the opinion that the person in charge should be appointed within local community management while 6 believe that responsibility for improvement of irrigation system should be in the hands of the institutions in charge and departments on the Vojvodina Province level. It is interesting to note that a few respondents consider that it is not sufficient to establish one person or body in charge, but it has to be a synchronized system involving more subjects on all levels from local to national importance (3 respondents). Majority of the agricultural firm representatives consider that the institution in charge should be defined on the level of the Republic of Serbia either within Ministry of agriculture, forestry and water management or within Republic hydrometeorology department (6 respondents)

while 1 respondent hold opinion that responsible body should be organized on the province level. In case there is a person or body responsible for irrigation system improvement, majority of the respondents, both farmers and representatives of agricultural firms, would be willing to cooperate with them (44 respondents).

Sustainability

Drought hazard prediction/forecast may provide valuable data for a number of sectors of the society and economy, as well as to support development of optimal strategy planning for alleviating impacts of drought periods. However, majority of the farmers (27 respondents) are of the opinion that it is impossible to predict occurrence of drought periods, while the agricultural firm representatives were not sure whether such prediction of this natural hazard was possible (4 respondents) (Fig. 7.9b on page 346). Although the respondents were familiar with climate and meteorology forecast of drought, they consider such forecast as unreliable and insufficiently precise.

Majority of the local farmers regard that Hydrometeorology Department of Serbia does not have sufficient amount of continuous weather data series on specific weather elements (temperature, precipitation, evapotranspiration) that could provide precise forecast of drought periods in future. Therefore, in order to provide sustainability of production, both agricultural population and agricultural firms use short-term and mid-term methods of adapting to new climate conditions. Primarily this regards the following: change in the time of field works, in sowing density, biological protection methods, and change in method of soil treatment (short-term methods) and soil fertility improvement and selection of hybrid seeds with shorter vegetation period that are also more resistant to drought (mid-term methods). Possibility of establishing sustainable production in the new aggravated climate conditions depends on the local farmers' training and on the financial assets available. Unfortunately, among the respondents only the ones from agricultural business believe that they are prepared for agrarian adaptation, while as many as 43.2% of the local farmers regard they would not be able to adapt in case of worsening of the current climate conditions.

Majority of individuals in agriculture (18 respondents) and firms (7 respondents (100%)) would be prepared to take out loans for irrigation, but both groups state that they have insufficient information on current government plans for loans for irrigation systems.

Necessary assistance for alleviation of adverse drought consequences includes subsidies for irrigation, improvement and reconstruction of the existing irrigation systems; organized and planned state management of agrarian policy; creating precise methods of forecast of drought periods and timely informing agricultural population and agricultural firms.

Forecast of drought hazard can provide precious data for a number of social and economic sectors, as well as to support development of more optimal planning of strategies for alleviating consequences of drought periods. Preparation for future drought periods, by means of developing optimal way of land use and water management should be the main goal of spatial planning in order to minimize consequences and damage caused by occurrence of drought. The most efficient adaptive strategies for prevention of drought period occurrence are change in the way of using agricultural land, reconstruction and development of the irrigation system, as well as selection of new sorts and hybrids that are drought-resistant and capable of using the available water more efficiently. However, these strategies require substantial financial investment and long-term implementation.